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POLLUTION OF NAVIGABLE WATERS BY THE OPERATION OF WATERCRAFT IN THE MISSOURI BASIN REGION

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
KANSAS CITY, MISSOURI

MARCH 1967

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Technical Programs
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Federal Water Pollution Control Administration
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Pollution of navigable waters resulting from operation of watercraft, currently not considered serious in comparison with other known pollutants, is expected to become more serious with the steady increase in recreational watercraft. Main causes of pollution are discharge of sewage, dunnage, and other wastes; occasional spills of oil, chemicals, grains, etc., resulting from accidents; and related activities such as servicing and cleaning equipment. Main problem areas are docks and marinas where boats are serviced and large numbers of watercraft congregate. Pollution problems can be improved by requiring installation of sewage treatment devices on all boats having toilet facilities and installation of onshore facilities for handling waste stored on watercraft.

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POLLUTION OF NAVIGABLE WATERS BY THE OPERATION OF WATERCRAFT IN THE MISSOURI BASIN REGION

Summary of Findings and Conclusions

1. Pollution of navigable waters resulting from the operation of watercraft occurs in various places throughout the Missouri Basin Region. Limited measurable amounts of pollution havebeen observed in congested areas near marinas and boatdocks. Pollution from this source has not been considered especially serious by the State agencies of this Region when compared with other known pollution sources.

2. There are nearly a half a million boats registered for recreational purposes in the ten states of the Missouri Basin Region. The number of boats being used increases each year. The problem of pollution from watercraft will increase and become far more serious unless a suitable program of abatement and control is developed.

3. The main causes of pollution are the discharge of sewage, dunnage and other wastes or debris, occasional spills of oil, chemicals, grains, etc., resulting from accidents and related activities such as servicing and cleaning equipment.

4. The main problem areas are docks and marinas where boats are serviced and large numbers of watercraft congregate. There are also problems in coves where houseboats and/or floating dormitories are moored for extended periods of time.

5. Means for correcting, eliminating or preventing the pollution problems are (1) the requirement for installation of sewage treatment

devices on all boats having toilet facilities, (2) the licensing of such boats, and (3) the installation of onshore facilities for handling waste stored on watercraft.

6. Regulations, to be effective, will have to be properly enforced.

7. Assuming that uniform national standards are developed for sewage disposal devices on small watercraft, consideration must be given to fixing the responsibility for enforcement, such as the U. S. Coast Guard is now doing for safety aspects. This would require the enactment of preferably uniform State laws and regulations. An intensive public education program, combined with an annual Federally supported symposium on this subject, would be very desirable and bring together new knowledge and all interested viewpoints.

Recommendations

1. There should be uniform State laws or a national law to control pollution originating from watercraft.

2. Provisions should be made for the implementation of such laws to assure their effectiveness.

3. Small boats (under 16 feet) do not have adequate space for toilet facilities and installation on small boats should be prohibited. Medium sized boats should be required to use holding tanks. Large boats should be equipped with adequate waste treatment facilities.

4. All toilet facilities on boats should be "sealed" when boats are moored or anchored in marinas, recreation or other congested areas.

5. Adequate onshore facilities to accommodate boaters and provide treatment for stored wastes of all sorts collected on boats should be

provided.

6. A definite program to correct, eliminate or prevent pollution from watercraft should be implemented.

Regional Characteristics

The Missouri Basin Region includes the United States portion of the entire watershed of the Missouri River system and the drainage areas of the Souris, the Rainy and the Red River of the North Rivers. The St. Mary and Belly Rivers and their tributaries in Montana are also included in the Region.

The Missouri River, the longest river in the United States, flows 2,464 miles from Three Forks, Montana, to its confluence with the Mississippi a few miles above St. Louis, Missouri. The Missouri River system drains an area of 529,000 square miles of the United States and Canada, of which about 9,700 square miles lie north of the international boundary.

The Souris, the Rainy and the Red River of the North and their tributaries flow into Canada. These river systems drain approximately 44,000 square miles of the United States. The Rainy River forms a boundary between the State of Minnesota and the Province of Ontario.

The total drainage area in the United States is about one-sixth of the total area of the Nation and includes a part or all of ten states. The area is comprised of rolling or gently sloping plains and prairies, bordered on the west by the Rocky Mountains with the Ozark highlands to the south. Within the plains area, the Black Hills of South Dakota are a principal topographic feature. The Basin also includes a portion of the lake country of Minnesota.

The Missouri River, with its tributaries, rises to elevations of 14,000 feet and joins the Mississippi River at an elevation of 400 feet.

The maximum, average and minimum flows at the mouth are about 900,000, 83,000 and 4,000 cubic feet per second, respectively. The Missouri River has 30 major tributaries, varying in length from 100 to 1,000 miles and draining areas varying in size from 2,400 square miles to 90,000 square miles.

The area has a widely divergent climatic characteristic. The annual rainfall ranges from about six inches for a limited area in the northwestern plains to 44 inches in the lower basin. Seasonal rainfall over most of the basin is highly variable and the annual rainfall can vary from less than half of the normal to several times the normal rainfall. There is also a wide range in temperatures, from -60° to 120° F. Below zero to over one hundred degrees is experienced in much of the basin.

The Ten Basin States have a total land area of 857,500 square miles, and a water area of approximately 14,800 square miles. Table 1 shows acreages of permanent water and wetlands in the Missouri Basin Region States.

Table 1

Acreages of Permanent Water and Wetlands, Missouri Basin Region States [1/]

State	Land Area Approximate Sq. Miles	Acres of Permanent Water						Water Area Grand Total
		Wetlands [2/]	Irrigation Waterways	Streams	Reservoirs [3/]	Lakes	Total [4/]	
Colorado	103,900	404,389	0	11,704	17,368	12,300	41,372	445,661
Iowa	56,000	138,077	0	173,029	0	41,921	214,950	353,027
Kansas	82,100	204,166	0	23,384	50,597	4,180	78,161	282,327
Minnesota	80,000	696,997	0	12,506	42,731	1,393,159	1,448,396	2,597,760
Missouri	69,200	376,913	0	39,953	7,800	8,388	56,141	433,054
Montana	145,900	187,432	0	196,700	301,428	147,088	647,216	832,648
Nebraska	76,700	649,842	0	258,056	64,072	0	322,128	971,970
North Dakota	70,100	1,523,265	0	64,822	377,602	40,699	483,123	2,006,388
South Dakota	76,500	751,988	518	89,338	470,800	3,083	503,739	1,305,727
Wyoming	97,100	30,266	4,555	21,644	106,096	104,169	236,564	266,830

1/ Includes total area in State, both in and out of the Missouri Basin Region; data (except Column 6 "Reservoirs") obtained from wetland and permanent water inventory reports prepared by the Fish and Wildlife Service, Distribution and Status of Waterfowl in the Missouri River Basin, MRBS, 1957.

2/ Wetlands included will permit at least use of canoes or small flat bottom boats. Nebraska's sandhill lakes are recorded as wetlands.

3/ Conservation pools in reservoirs administered for recreation and wildlife within Missouri River Basin only - July 1, 1965 "Reservoir Management and Use in the Missouri River Basin," MRB, Department of the Interior, September 1965. State, county, or municipal reservoirs are not included.

4/ "Total" does not include wetlands.

Navigable Waterways

The Missouri River is navigable from St. Louis to Sioux City, Iowa. The commercially navigable inland waterway consists of 753 miles of improved open channel which permits navigation during the 8 month ice-free season. An extension of the channel to river mile 808 in the vicinity of Yankton, South Dakota, has been proposed.

There are approximately 40,000 miles of navigable streams in the Missouri Basin Region. The total surface area of reservoirs is 1,438,494 acres. The lakes in the Ten State area have a total acreage of 1,654,978 acres. The major tributaries of the streams and major reservoirs of the area are listed in Tables 2 and 3.

Type and Number of Watercraft

Over the past few years, there has been a considerable increase in the number of recreational watercraft registered with State agencies. As of the first of January 1967, there were registered 487,082 boats in the Ten States of the Missouri Basin Region. The distribution of these registrations is shown on Table 4. One of the States in the Region estimates that with the coming of spring, that an additional 10,000 recreational watercraft will renew their expired registration.

There are over 300 public recreational areas in the Missouri River Basin, not including small municipal parks or private areas which include boating facilities. The Bureau of Outdoor Recreation estimates that the activity days for boating will exceed 23 million in 1980 and increase to over 44 million activity days by 2020. They expect the

Table 2

Major Rivers of the Missouri Basin Region

Name of River	Where River Rises	River Mileage
Missouri	Montana	2,464
Gallatin	Montana	120
Jefferson	Montana	207
Madison	Montana	183
Sun	Montana	126
Milk	Montana	687
Yellowstone	Wyoming	671
Powder	Wyoming	486
Tongue	Wyoming	265
Big Horn	Wyoming	336
Little Missouri	Montana	560
Cannonball	North Dakota	295
Grand	South Dakota	329
Moreau	South Dakota	373
Cheyenne	South Dakota	340
Belle Fourche	Wyoming	316
White	Nebraska	507
James	North Dakota	710
Platte	Nebraska	310
Elkhorn	Nebraska	333
South Platte	Colorado	442
North Platte	Wyoming	680
Kansas	Kansas	175
Republican	Colorado	544
Smoky Hill	Colorado	562
Big Blue	Nebraska	287
Grand	Iowa	217
Osage	Kansas	496
Platte	Iowa	253
Chariton	Iowa	280
Gasconade	Missouri	270
Rainy River	Minnesota & Canada	215
Red River of the North	Minnesota & South Dakota	394
Souris	Canada	360

There is commercial navigation on 753 miles (improved open channel) of the Missouri, St. Louis, Missouri to Sioux City, Iowa.

February 1967

Table 3

Major Reservoirs in the Missouri Basin Region

As Listed "Reservoirs in the United States" USGS 1360-A

State & Name	Stream	Surface Area (Acres)
COLORADO		
Antero	South Fork South Platte	4,886
Barker Meadow	Middle Boulder Creek	-
Barr Lake	South Boulder Creek	1,860
Base Line	South Boulder Creek	800
Black Hollow	Cache La Poudre	575
Bonny	South Fork Republican	8,300
Boyd Lake	Big Thompson	1,700
Timnath Lake	Cache La Poudre	-
Carter Lake	Lake Thompson	1,158
Cheeseman Lake	South Platte	874
Cherry Creek	Cherry Creek	2,645
Cobb Lake	Cache La Poudre	520
Douglas	Cache La Poudre	586
Eleven Mile Canyon	South Platte	2,800
Empire	South Platte	2,700
Fossil Creek	Cache La Poudre	840
Halligan #16	North Fork Cache La Poudre	4,780
Lonetree	Big Thompson	536
Horse Creek	South Platte	-
Horsetooth	Cache La Poudre	1,899
Jackson Lake	South Platte	2,500
Jumbo	South Platte	1,470
Loveland Greeley	Big Thompson	472
North Poudre #6	North Fork Cache La Poudre	600
Panama Reservoir #1	Boulder Creek	400
Point of Rocks	South Platte	-
Prewitt	South Platte	2,430
Prospect	South Platte	400
Reservoir #8	Cache La Poudre	525
Reservoir #22	South Boulder	413
Seven Lakes	Big Thompson	717
Standby Lake	South Platte	1,310
Terry Lake	Cache La Poudre	500
Union	St. Vrain Creek	950
Windsor	Cache La Poudre	1,000
IOWA		
None listed		

Major Reservoirs in the Missouri Basin Region (cont'd)

State & Name	Stream	Surface Area (Acres)
KANSAS		
Cedar Bluff	Smoky Hill	10,790
Kanopolis	Smoky Hill	-
Kirwin	North Fork Solomon	14,600
Showme	Deer Creek	411
Tuttle Creek	Big Blue River	53,000
Webster	South Fork Solomon	10,600
Wyandotte	Marshall Creek	305
MINNESOTA		
Dead Lake	Dead River	7,708
East Battle Lake	Battle Lake Outlet	2,442
Height of Land Lake	Otter Tail River	3,941
Lizzie Lake	Pelican River	6,242
Melissa Lake	Pelican River	1,791
Namakin Chain	Rainy River	66,600
Otter Tail Lake	Otter Tail River	14,745
Pelican Lake 16-4	Pelican River	11,800
Pelican Lake 9-36	Pelican River	4,200
Pine Lake	Otter Tail River	4,820
Rainy Lake	Rainy River	221,000
Rush Lake	Otter Tail River	5,233
Sturgeon	Sturgeon River	2,694
Thief Lake	Thief River	7,100
White Rock (Lake Traverse)	Boise de Sioux River	22,950
MISSOURI		
Lake of the Ozarks	Osage River	59,700
MONTANA		
Ackley Lake	Judith River	241
Birch Creek (Swift Dam)	Birch Creek	450
Bynum	Teton River	4,120
Canyon Ferry	Missouri River	35,200
Cooney	Red Lodge Creek	862
Deadmans Basin	Musselshell River	1,894

Major Reservoirs in the Missouri Basin Region
(cont'd)

State & Name	Stream	Surface Area (Acres)
MONTANA (cont'd)		
Delmoe Park	Pipestone Creek	479
Durand	North Fork Musselshell River	272
Ennis Lake	Madison River	3,800
Fort Peck	Missouri River	245,000
Four Horns	Badger Creek	897
Frenchman	Frenchman Creek	806
Fresno	Milk River	5,757
Gibson	Sun River	1,360
Hauser Lake	Missouri River	3,899
Hebgen	Madison River	13,400
Holter	Missouri River	4,800
Lake Adam	Sweetgrass Creek	585
Lake Frances	Depuyer and Birch Creeks	5,536
Lake Helena	Missouri River	2,100
Lake Walvoord	Sweetgrass Creek	768
Lima	Red Rock River	6,400
Lower Two Medicine Lake	Two Medicine River	806
Martinsdale	South Fork Musselshell River	985
Middle Creek	Hyalite Creek	222
Morony	Missouri	300
Nelson	Milk River	4,560
Petrolia	Flat Willow and Elk Creeks	515
Pishkun	North Fork Sun River	1,550
Ruby River	Ruby River	358
Smith River (White Sulphur)	Smith River	322
Tiber	Marias River	22,180
Tongue River	Tongue River	3,732
Warhouse Lake (Warhorse)	Buffalo Creek	-
Willow Creek	Lodgegrass Creek	750
Willow Creek	Sun River	1,450
Willow Creek	Willow Creek	850
NEBRASKA		
Box Butte	Niobrara River	1,600
Ender	Frenchman Creek	2,560
Gavins Point	Missouri River	17,000
Harlan County	Republican River	22,800

Major Reservoirs in the Missouri Basin Region
(cont'd)

State & Name	Stream	Surface Area (Acres)
NEBRASKA (cont'd)		
Harry Strunk Lake	Medicine Creek	4,820
Jeffery Canyon	Platte River	620
Johnson	Platte River	2,420
Lake Alice	North Platte River	1,684
Lake Babcock	Loup River	900
Lake Maloney	North and South Platte Rivers	1,670
Lake Minatare	North Platte River	2,160
McConaughy Lake	North Platte River	32,200
Sutherland	Platte River	4,350
Swanson Lake	Republican River	10,000
NORTH DAKOTA		
Arrowwood Lake	James River	1,600
Dam 320	Souris River	3,000
Dam 326	Souris River	2,500
Dam 332	Souris River	-
Westhope Dam	Souris River	2,500
Dickinson	Heart River	867
Des Lacs Dam #2	Des Lacs River	4,000
Garrison	Missouri River	390,000
Heart Butte	Heart River	3,400
Jamestown	James River	13,200
Jim Lake	James River	1,689
Lake Alice		3,420
Lake Astabula	Sheyenne River	5,400
Lake Darling	Souris River	8,000
Long Lake	Apple Creek	13,700
Lords Lake	Willow Creek	778
White Lake	Wild Rice River	1,417
Willow Lake	Willow Creek	1,200
SOUTH DAKOTA		
Angostura	Cheyenne River	4,830
Belle Fourche	Belle Fourche River	7,695
Deerfield	Castle Creek	414
Fort Randall	Missouri River	107,000
Gavins Point	Missouri River	17,000

Major Reservoirs in the Missouri Basin Region
(cont'd)

State & Name	Stream	Surface Area (Acres)
SOUTH DAKOTA (cont'd)		
Lake Kampeska	Big Sioux River	5,500
Lake Sheridan	Spring Creek	380
Mitchell	Firesteel Creek	694
Oahe	Missouri River	376,000
Pactola	Rapid Creek	1,220
Shadehill	Grand River	4,800
White Rock (Lake Traverse)	Red River of the North	22,950
WYOMING		
Alcova	North Platte	2,250
Big Goose Park	East Fork Goose Creek	255
Big Sandy	Big Sandy Creek	2,600
Boulder Lake	Boulder Creek	1,680
Boysen	Bighorn River	22,200
Buffalo Bill	Shoshone River	6,711
Bull Lake	Bull Lake Creek	3,200
Cheyenne #2	Middle Crow Creek	190
Eden #1	Big Sandy Creek	1,180
Fremont Lake	Pine Creek	5,390
Guernsey	North Platte River	2,386
Hawk Springs	Horse Creek	1,531
Keyhole	Belle Fourche	13,690
La Prele	La Prele Creek	628
Pathfinder	West Platte	22,600
Pilot Butte	Wind River	900
Ray Lake	South Fork Wind River	-
Seminoe	North Platte	20,050
Upper Sunshine	Greybull River	1,159
Willow Lake	Lake Creek	1,945
Wyoming Development	Laramie River #1	378
	#2	6,750
	#3	7,597

Table 4

Boats Registered in the Missouri Basin Region States

State	Under 16'			16' to 26'			26'-40'			40'-65'			Over 65'		
	Inboard	Outboard	Other	Inboard	Outboard	Other	1	0	Other	1	0	Other	1	0	Other
Colorado	157	14,821		559	3,765		25	13			1				
Iowa	263	50,121		1,722	18,919		279	454		22	23		2	383	
Kansas	182	16,826		1,380	7,401		22	68		1	3		1		
Minnesota	2,575	166,858	9,348	4,470	64,206	2,917	1,426	959	41	152	52	5	1	3	1
Missouri	339	37,620		3,469	16,797		884	391	a/	68	38		1	5	
Montana	34	6,209	17	293	3,081		48	21	217	3					
Nebraska		17,997			4,242			45							
North Dakota	11	4,631	14	66	2,195	134	19	86	3		5				
South Dakota		10,003			2,839			64			4				
Wyoming	12	3,676		258	1,692		16	14		1					
TOTAL		341,714			140,405			4,187			379			397	

a/ 16' and over

Registration includes:

Colorado - Every motorboat and sailboat
Iowa - Every motorboat
Kansas - Every motorboat powered by more than 10 horsepower
Minnesota - All watercraft
Missouri - Every motorboat powered by more than 10 horsepower
Montana - Every motorboat powered by more than 10 horsepower
Nebraska - All craft powered by any mechanical device for propelling it on public or private water of State
North Dakota - Every motorboat powered by more than 10 horsepower
South Dakota - Every motorboat powered by more than six (6) horsepower
Wyoming - Every motorboat powered by more than five (5) horsepower

activity days for water skiing to be approximately 3 million by 1980 and exceed 5 million by the year 2020.

There are 29 commercial towboats operating on the Missouri River. There were 359 tows during 1966 with an average of 15 tows on the river daily, with a total operation of 93,000 hours during the year.

The U. S. Army Engineer District Office in Kansas City owns and operates one tugboat, one survey boat and two dredges. The Omaha District of the Corps of Engineers operates one dredge, four towboats, four launches, and three survey boats. The Coast Guard operates seven cutters. Table 5 shows the operating time in 1966 and the types of waste disposal provided on the boats. Four Government launches operate in upstream main stem reservoirs.

There are no available records of recreational boating on the main streams. There are a number of organized cruises such as the annual 300 miles boat trip on the Missouri River from Ft. Benton to Ft. Peck. All of the reservoirs have boat launching facilities, most have piers and some have marinas, small craft harbors and yacht clubs.

Boats are available for renting at some of the larger reservoirs and parks. In Yellowstone Park during 1966, 34,300 private boat permits were issued. The total use of concessionaire-owned boats was 88,078. The total boat days on Yellowstone Lake in 1966 was 120,663.

A number of houseboats are seasonally anchored below Gavins Dam on the main stem of the Missouri River. Houseboats and floating dormitories are anchored during the warmer season in selected coves of the

Table 5

Commercial and Federal Watercraft Operating in the Missouri Basin

Type Craft	Owned or Operated By	Avg. Pass. & Crew Ea. Boat	No. Craft in Operation	No. Trips in 1966	Avg. No. Boats Oper. Daily	Op. Time 1966 Avg. Days Per Boat	Op. Time 1966 Hrs. Per Day	Op. Time 1966 Months	Type Disposal
Towboat	Army Engrs., Kansas City	20	1				24	6	Central Maceration
Survey Boat	Army Engrs., Kansas City	3	1				8	8½	Package Maceration
Dredge	Army Engrs., Kansas City	50	2				24	6 ea.	Central Aerobic
Dredge	Army Engrs., Omaha	53	1			0	0	0	Central Aerobic
Towboat	Army Engrs., Omaha	2	4			150	8		Package Maceration
Launch	Army Engrs., Omaha	2	4			40	8		Package Maceration
Survey Boat	Army Engrs., Omaha	2	1			176	8		Package Maceration
Survey Boat	Army Engrs., Omaha	3	2			150	8		Package Maceration
Cutter	Coast Guard	13	2				24	9 ea.	Package Maceration
Cutter	Coast Guard	13	1				24	8	Package Maceration
Cutter	Coast Guard	13	4				24	12 ea.	Package Maceration
Work Boats	River Const. Cntrctrs.	3	44			170	8		None
Pile Driver	River Const. Cntrctrs.	8	18			70	8		None
Towboats	Commercial Barge Lines	14	*29	359	*15	**258	24		None

*Total of 29 commercial towboats in Missouri River service and an average of 15 are in river daily.

**258 is average for 15 towboats with total operation 93,000 hours for 1966

Table 6 - Watercraft Use on Missouri Basin Reservoirs

Name of Development	GENERAL DATA: Total Area (Acres)	GENERAL DATA: Normal Water Surface (Acres)	SPECIFIC FACILITIES: Parking Car Spaces	SPECIFIC FACILITIES: Toilet Bldgs.	SPECIFIC FACILITIES: Camp Ground	SPECIFIC FACILITIES: Cottages 1/	SPECIFIC FACILITIES: Launching Ramps	SPECIFIC FACILITIES: Boat Docks	WATER CRAFT USE: Total (Boat Days)	WATER CRAFT USE: Peak Day Use	Remarks
COLORADO											
Bonny	7,229	2,042	300	16	3	9	3	0	2,743	132	
Carter Lake	2,054	1,444	650	24	3	0	3	1	24,260	627	
Horsetooth	3,877	1,899	1,650	40	6	0	9	1	36,545	587	
Lake Estes	308	185	365	6	0	0	1	1	1,507	44	
Rattlesnake	240	97	110	4	2	0	1	0	1,562	44	
Cherry Creek	5,348	880	6,500		2	0	10	1		266	12,750 water skiers
Colorado-Big Thompson Project											
Granby	17,638	7,256	310	31	3	120	3	0	7,651	214	
Green Mountain	4,373	2,125	250	18	0	0	5	1	3,021	90	
Shadow Mountain	2,449	1,346	40	11	3	150	3	0	5,381	182	
Willow Creek	968	303	25	8	4	0	2	0	389	10	
KANSAS											
Cedar Bluff	15,125	6,869	70	7	6	78	8	1	2,065	225	
Kanopolis	21,250	3,550	900		8	0	8	0		342	16,000 water skiers
Kirwin	11,447	4,937	2,000	15	3	30	2	1	3,580	38	
Lovewell	6,576	2,986	375	17	1	39	5	1	3,895	171	
Webster	6,930	3,445	600	7	2	43	3	8	2,050	60	
Milford	25,500	15,600	12,364								
Norton	7,482	2,181	125	3	1	0	3	0	633	44	
Pomona	10,500	4,000	558		9	0	16	0		826	30,000 water skiers
Tuttle Creek	33,900	15,800	1,492		15	0	53	0		682	25,000 water skiers
Wilson	21,842	9,000	350		0	0	12	0		189	6,600 water skiers
MISSOURI											
Pomme de Terre	18,350	7,800	860		14	0	48	0		1,800	120,000 water skiers
MONTANA											
Tiber Reservoir	37,542	22,180	1,000	22	11	8	4	0	1,020	76	
Clark Canyon Reservoir	9,338	4,935	150	10	4	0	3	0	3,050	55	
Canyon Ferry Reservoir	42,849	35,200	1,000	29	11	365	4	3	7,800	412	
Fishkun Reservoir	4,193	1,550	0	4	0	0	0	0	250	10	
Sleeping Buffalo Wildlife Management Area	1,312	450	0	0	0	0	0	0	14	6	
Willow Creek Reservoir	4,599	1,530	0	4	0	0	0	0	1,050	45	
Fresno Reservoir	32,970	5,760	0	0	0	33	0	0	1,100	70	
Gibson Reservoir	9,549	1,360	0	0	0	34	0	0	30	4	
Greenfields Lake	5,981	2,940	130	0	0	0	1	0	38	8	
Nelson Reservoir	11,623	4,560	25	2	0	56	0	0	125	10	
Bowdoin Lake	13,440	7,620	3	0	0	0	1	0	25	20	
Fort Peck	609,774	212,000	1,300		6	74	10	0		790	16,170 water skiers
NEBRASKA											
Antelope and Salt Creek Dams	6,249	2,080	1,920		4	0	16	5		478	45 water skiers
Harlan County	31,050	13,600	1,100		11	9	8	2		375	6,000 water skiers
Box Butte	2,260	1,600	50	8	2	0	1	0	1,200	34	
Enders	5,629	1,707	350	8	1	25	1	0	1,151	26	
Harry Strunk Lake	8,943	1,768	120	6	0	22	4	0	2,252	38	
Hugh Butler Lake	6,089	1,628	395	6	1	8	3	0	8,058	126	
Lake Minatare	3,082	2,158	400	18	0	14	4	17	5,525	105	
Gavins Point (Lewis & Clark Lake - Nebr.-S.D.)	43,619	28,000	3,846		28	0	27	11		914	24,683 water skiers
Merrit Reservoir	9,898	2,906	136	10	0	0	1	1	2,000	52	
Sherman	7,840	2,845	360	16	1	39	2	2	15,420	382	
Swanson Lake	8,642	4,974	695	8	1	12	3	2	3,663	60	
NORTH DAKOTA											
Garrison	489,860	369,500	1,110		10	11	69	6		1,996	25,000 water skiers
Edward Arthur Patterson Lake	2,257	867	150	5	4	16	1	6	3,060	47	
Jamestown Reservoir	4,609	2,095	550	16	0	67	5	30	12,600	430	
Lake Tschida	10,746	3,400	200	18	8	84	2	10	8,300	550	
SOUTH DAKOTA											
Oahe	487,507	313,000	2,727		17	0	58	3		150	1,680 water skiers
Big Bend (Lake Sharpe)	60,117	55,800	2,170		4	0	36	4		554	276 water skiers
Cold Brook	483	36	125		2	0	0	0		4	
Angostura Reservoir	9,251	4,830	1	20	1	26	2	100	630	40	
Factola Reservoir	3,984	1,220	350	45	3	0	3	0	5,050	150	
Shadehill Reservoir	13,158	4,800	60	24	2	42	3	12	1,750	52	
Belle Fourche Reservoir	14,720	8,040	0	0	0	6	0	0	317	45	
Deerfield Reservoir	2,259	414	81	11	2	0	1	0	800	62	
Fort Randall (Lake Francis Case)	146,358	81,700	1,650		8	0	72	0		438	20,400 water skiers
WYOMING											
Boysen Reservoir	44,720	19,660	1	12	1	15	2	0	515	130	
Pilot Butte Reservoir	1,116	900	0	0	0	0	0	0	30	3	
Ralston Reservoir	287	100	0	0	0	0	0	0	40	5	
Alcova	6,953	2,500	300	11	4	101	7	25	43,054	1,275	
Glendo	21,998	12,000	0	9	1	46	2	35	9,290	113	
Gray Reef	241	181	120	1	0	0	1	0	100	2	
Guernsey	8,576	2,382	300	9	6	17	1	0	5,520	80	
Kortes	2,120	83	50	2	1	0	0	0	25	2	
Pathfinder	46,134	22,011	0	2	0	0	2	2	6,500	150	
Seminoe	43,778	20,050	0	4	0	2	1	0	4,905	54	
Keyhole Reservoir	16,134	9,420	1	8	1	0	0	0	3,112	74	
Lake Cameahwait	1,422	365	0	0	0	0	0	0	420	20	
Ocean Lake	8,650	6,248	0	6	0	0	5	1	4,100	110	
Buffalo Bill Reservoir	12,020	6,690	0	5	2	16	2	2	5,104	63	
Bull Lake Reservoir	3,388	3,186	0	6	0	0	0	0	1,000	50	
Deaver	207	80	0	2	0	0	0	0	300	15	

Data available only on Bureau of Reclamation and Corps of Engineers projects. Shown are those that include boating as a functional use.

1/ Permanent residences or rental units.

major reservoirs. These conditions exist from Canyon Ferry Reservoir on the Upper Missouri in Montana to the Lake of the Ozarks in Missouri.

Causes

Sanitary Wastes (Domestic Sewage)

These organic wastes contain high concentrations of solid materials and possibly pathogenic organisms. Concentrations of such wastes can become a health hazard to the users of waterways and cause depletion of the dissolved oxygen, which may result in fish kills. Pathogenic organisms (in the sewage) could infect swimmers or anyone else who comes in contact with the water.

Litter

The people contacted were of the opinion that litter was from onshore activity rather than from boating. It was their opinion that while litter may not create pollution, it does create a nuisance.

Other Solid Wastes

The disposal of garbage, rubbish, and trash can and does create unsightly conditions. It was the opinion of those contacted that this usually results from onshore activity rather than from boating.

Accidental Spills and Discharges

Accidental spills may result from collisions, sinking of barges or the loss overboard of open containers. It may also result from the servicing of boats which could introduce oil, gasoline or greases into

the water. The discharge of such material may result in fire hazards and will certainly cause discoloration of vessels, piers, docks and other water structures.

The transporting of cattle by barge apparently was quite successful and there may be additional barging of cattle on the River. This could result in considerable pollution with the washing overboard of animal wastes.

Two serious spills which have occurred recently were both land-based. One resulted from a fire of a chemical plant in Omaha. The other was the result of a ruptured storage tank of fertilizer chemical in the Sioux City area.

Public water supplies could be endangered and fish kills may result from the spills of poisonous materials.

Problem Areas

Surveys of the Lake of the Ozarks found no visible pollution. Chemical and bacteriological analysis indicated very little, if any, pollution in the main channel of the lake. There are local points of pollution, in coves having large concentrations of people either in private homes or resorts, and used for swimming and storage of cabin cruisers.

A survey was made of the various State, local and Federal establishments in the Missouri Basin Region in an effort to determine the location and the seriousness of pollution problems. There were no

reports of any specific areas of serious pollution from the operation of watercraft. The State officials of the Region provided the following information:

Colorado

The following information received from Mr. Frank Rozich, Technical Secretary, Water Pollution Control Commission:

"The authority for controlling pollution from boats in Colorado is, at present, vested in the Game, Fish and Parks Department. After consultation with our department, they have included among their laws a requirement that there shall be no waste treatment facilities aboard any type of vessel. Holding tanks with discharge to a land station is the only acceptable means of handling wastes on boats."

Iowa

The following information received from Mr. R. J. Schliekelman, Director of Water Pollution Division:

"We have consulted with the State Conservation Commission as to the extent of the problem and that agency and this Department are of the opinion that pollution created by watercraft was minor as compared with municipal and industrial sources. Approximately 65,000 power boats (inboard & outboard) are registered by the Commission, and it is estimated much less than 1% have toilet facilities. A question regarding available toilet facilities is included in this year's registration form.

"An agreement has been reached with the Corps of Engineers in which they will require "pump out" facilities for newly developed areas to accommodate boats with holding tanks.

"A meeting with the Conservation and Health Department officials of Nebraska and South Dakota was held last year for the purpose of discussing uniform regulations. This is to avoid difficulties now existing with nonuniform requirements on the Upper Mississippi River.

"The Commission would prefer no legislation in the present legislative session because of possible opposition from the Outboard Boating Club Association. Legislation requiring holding tanks for storage of water from marine toilets will be considered as a more positive means of control. A reasonable period for use or conversion of existing discharge type of equipment would be provided."

Kansas

The following information received from J. Lee Mayes, P.E., Chief Engineer and Director of Environmental Health Services:

"We do not regard discharges from vessels (watercraft) operating on streams and reservoirs in the state to be a serious source of water pollution and we do not have any legislation at the present time that deals with this problem per se.

"Since 1963, as a courtesy to the Corps of Engineers, we have provided a certification program for marine toilets located in watercraft operating on Corps-managed impoundments. In the three years we have received less than 25 requests for certification. For certification, we required maceration and chlorination of sewage prior to discharge. While numerous boat owners installed the required equipment, an equal or larger number of owners removed the toilet or made it inoperative by installing a blind flange.

"We do not anticipate any appreciable increase in use of vessels equipped with marine toilets in the state in the foreseeable future. Should such an increase occur, we would seek appropriate legislation to control any water pollution problems that arose."

Minnesota

The following information received from Dr. Robert N. Barr, Secretary of the Water Pollution Control Commission. His comments refer to the entire State:

"Pollution of this type occurs in various places throughout the state but is not considered especially serious relative to other sources of pollution such as municipalities and industries. There are an estimated 5000 pleasure boats with toilets licensed in Minnesota, and an undetermined number of commercial craft such as barges and ships using the Great Lakes and Upper Mississippi Waterway.

"The main causes are discharges of sewage, dunnage and other wastes or debris; occasional spills of oil, grain, etc., resulting from accidents, and related activity such as barge cleaning.

"The main problem areas are in the Seaway Port of Duluth and those portions of the Minnesota, Mississippi and St. Croix rivers which are maintained for commercial navigation. The larger pleasure craft, especially those with more than one toilet, are used mainly on these waters for the larger inland lakes. Except possibly in a few heavily used anchorages, these discharges are not considered a serious problem.

"One of the means for correcting or eliminating the problem is the present requirement for installation of sewage treatment devices on

all boats having toilets and licensed in Minnesota. Other means, such as the requirement for obtaining permits for barge cleaning facilities, are also used. In the Port of Duluth garbage collection and incineration is furnished as a service to domestic vessels.

"Additional means for garbage and dunnage collection, and sewage treatment are needed for barge tows and commercial ships, especially foreign vessels. Documented watercraft, which are not licensed by Minnesota, are also currently exempt and should be regulated by the appropriate federal agency. It would be desirable to have uniform national requirements for sewage treatment devices for small watercraft to avoid conflicts with other states due to differing requirements. In addition, an intensive public education program would be helpful. Assuming uniform national standards are developed for sewage disposal devices on small watercraft, consideration might be given to fixing the responsibility for enforcement on the U. S. Coast Guard as it is now done for safety aspects. An annual, federally supported symposium on this subject would be very desirable to bring together all interested viewpoints and new knowledge.

"A copy of the Minnesota law relating to disposal of wastes from watercraft is enclosed, plus related material. An amendment to this law has been proposed by the Water Pollution Control Commission. It would provide for reciprocity for boat owners having treatment devices accepted or approved by other states in which their boats are licensed, in a manner similar to what is now done in other fields, such as automobiles. The existing water pollution control statutes and anti-litter

laws also apply in this matter.

"Specific data on this problem have not been compiled by the Water Pollution Control Commission. However, the Minnesota-Wisconsin Boundary Area Commission has recently been concerned with the problem on the St. Croix River and they may possibly have some useful information."

Missouri

The following information received from Mr. Jack K. Smith, Executive Secretary, Missouri Water Pollution Board:

"We have very little information to offer. Our survey of the Lake of the Ozarks made in connection with several State and Federal Agencies, revealed that the coliform counts are relatively high near marinas that are occupied on weekends. The survey also indicated that on Monday and for the remainder of the week the coliform counts were relatively low in the marina area where cabin cruisers equipped with marine toilets were tied up.

"We also have received complaints from persons in the Bagnell Dam area where the large excursion type boats are tied up. The complaints list oil on the water as the pollution they observe. This appears to be caused from careless filling of the fuel tanks. This is all of the information we have available from marine installations."

Nebraska

The following information received from T. A. Filipi, Director, Environmental Health Services:

"To the best of our knowledge, we have no evidence of gross pollution of interstate waters from the discharge of vessels.

"At the present time, representatives of the Game, Forestation and Parks Commission and we, are working on some type of regulation and possible code that would correct and prevent pollution of the Missouri River from this source. It is our opinion that the houseboats on our big reservoirs likewise will be causing a problem in the future, therefore, regulations on this will be necessary."

North Dakota

The following information received from Norman L. Peterson, Director, Division of Water Supply and Pollution Control:

"There are extremely few boats in the State that have toilet facilities on board. These would be located on our large reservoirs. At the present time, this source of pollution would be of extremely minor nature. However, we are interested in this source of pollution and are gathering in our files the various methods of treatment which have been developed for use by boats, along with the findings of other states as to their approval. We do intend to take all necessary steps to prevent this from becoming a pollution problem."

South Dakota

The following information received from Charles E. Carl, Director, Division of Sanitary Engineering:

"Section 25.1405(10) of the Game, Fish and Forestry Laws pertains to requirements of vessels equipped with kitchen or toilet facilities.

"Every vessel equipped with kitchen or toilet facilities shall be so equipped and operated to handle or treat liquid and solid wastes in a manner that will prevent pollution of the receiving waters.

"A copy of the regulations relating to the construction and installation of marine toilets with the above section of the Law is enclosed.

"The status of vessel pollution in the state is as follows:

A. No arrests have been made under this law.

B. Investigations by the Department of Game, Fish and Parks have been conducted in the North Point-Pickstown area and the Yankton area. Approximately 35 boats have been surveyed.

C. The general compliance with these laws has been very good. The persons operating these vessels have been informed that the kitchen and toilet facilities should not discharge wastes while the boats are operating on the waters of this State.

"Water pollution from vessels is not yet a problem in South Dakota."

Wyoming

The following information received from Frank R. Harman, Public Health Engineer:

"Presently, in Wyoming, as in the past, we are not faced with any problem of magnitude regarding water pollution resulting from the operation of vessels in our lakes or streams. Consequently we regret that we are unable to supply any information on the subject which will be of a useful nature to you in the comprehensive study being undertaken."

Existing Means and Methods of Correcting or Eliminating Pollution

The four existing means or methods of abatement of water pollution from watercraft are holding tanks, macerator-chlorinator devices,

incinerator devices and package aerobic sewage treatment plants.

Holding Tanks

Holding tanks from which the waste waters are pumped to onshore sewage treatment installations provide adequate handling of wastes and have the greatest appeal to the State Health officials in the Region. Chemicals may be added to the holding tank for control purposes. The use of holding tanks will require adequate supporting onshore sewerage installations to receive and treat the wastes.

Macerator-Chlorinator Devices

Macerator-chlorinator devices are the most popular watercraft sewage treatment device in use. These are designed to hold marine toilet wastes for at least a nominal period of time to permit introduction of a disinfectant to kill the bacteria and to break up the solids to permit better disinfection. Tests that have indicated large initial bacterial kills from these units do not indicate the regrowth potential of the solids of approximately ¼" in dimension. The effectiveness of the disinfectant after the effluent leaves the boat is difficult to determine.

Incinerators

Incinerator units are designed to trap toilet waste material in a bowl liner or bag and hold the material until the device is activiated. An auxiliary fuel is used for the incinerating process to reduce the waste to a small quantity of inert ash. While such equipment has been accepted as to its pollution control capabilities, there is a fire hazard involved.

Package Aerobic Sewage Treatment Plants

Extended aeration treatment systems are now on the market for shipboard installation where space is available and the complement of passengers is large enough to justify such an installation. The disadvantages are the same as onshore installations of similar units. High power cost operational problems associated with sludge removal and pumping. Based on laboratory analysis, such sewage treatment plants with proper operation and maintenance are capable of providing adequate treatment to prevent water pollution.

The Minnesota Water Pollution Control Commission is charged with responsibility for evaluating sewage treatment devices for use with toilets on watercraft, and has up to the present accepted six such devices for use in Minnesota. These are, in chronological order of acceptance:

1. C-Chlor Mark 5, by Carlson & Son, Metuchen, N.J. (December 21, 1962).
2. Marine Chlorinator, by Apollco Corp., Victoria, Minnesota (April 18, 1963).
3. Destroilet, by LaMere Industries, Walworth, Wisconsin (February 27,1964).
4. & 5. Mono-Marine & MonoMatic Sanitation Systems by Monogram Industries, Culver City, California (March 26, 1964, and February 28, 1966, respectively).
6. Sanitank System, by PEFCO, Inc., St. Paul, Minnesota (June 23, 1966).

The first two depend upon maceration and chlorination to achieve disintegration and disinfection of the sewage, the third is a gas incinerator, and the other three are storage units designed to be used in conjunction with onshore disposal facilities.

Some confusion and concern have been engendered among Minnesota boaters by public statements to the effect that not all of these devices are accepted for use by other states. It is unfortunately true that there is at present no nationwide uniformity among the states on this matter and no realistic likelihood of such uniformity in the near future unless it is imposed by federal legislation. There is now sufficient diversity of choice among the accepted units, however, so than any Minnesota boat owner should be able, with reasonable foresight to obtain a device which will be satisfactory and acceptable in the areas in which he plans to use his boat, whether in or out of Minnesota. The solution to the larger problem of uniformity among the states would appear to be best resolved at the state level by adoption of legislation aimed at establishing the principle of mutual acceptance of other states' actions, i.e., reciprocity in this matter in a manner similar to what is now done in other fields, such as licensing of boats, automobiles, drivers, etc., with non-state registered craft being controlled by the responsible federal agency. Federally sponsored research to determine adequate standards and test methods for sewage treatment devices for small watercraft is currently being done on a large number of units by the National Sanitation Foundation at Ann Arbor, Michigan.

Number of Vessels With Treatment Devices

Data are not available as to the number of waste treatment devices installed in recreational watercraft. A survey of State Health officials indicate that the number is quite small. It is estimated by equipment dealers in Kansas City, Missouri, that there might be as many as 25 vessels with macerator-chlorinator devices on the Lake of the Ozarks. Approximately 2 percent of the recreational watercraft over 20 feet in length may be equipped with treatment devices. This would total about 800 recreational craft.

Of the commercial and federal watercraft operating in the Missouri Basin, all of the Corps of Engineer and Coast Guard boats provide waste treatment as indicated on Table 5. Workboats and piledrivers of the river construction contractors and towboats of the commercial barge line do not provide any treatment. Thus, 23 federally-owned boats provide treatment facilities on the boat. Forty-four workboats of the river construction contractors with average passenger and crews of three each provide no treatment. Eighteen piledrivers of river construction contractors with average crews of eight provide no treatment and 29 towboats of commercial barge lines with average crews of fourteen each provide no treatment.

Additional Needs for Means or Methods for Correcting or Eliminating Pollution

Methods of waste disposal on watercraft are urgently needed which will compare with onshore secondary treatment facilities. The need for better treatment devices may become more apparent when the water quality standards are set by the States. Programs and measures, including onshore supporting installations, should be initiated immediately to abate or prevent pollution from watercraft.

Holding tanks which are particularly well-suited for handling wastes on smaller watercraft must have shore based installations to provide an adequate treatment of the marine toilet waste waters. Shore based facilities may be small package secondary sewage treatment plant with sewage collection systems to one or more marinas, concessionaires and/or permanently moored floating dormitories or houseboats. In some instances, an onshore sewage lift station and force main to a municipal sewerage system may provide a more satisfactory answer.

Incinerators may be used for disposal of galley garbage, trash, fish cleanings, etc.

Onshore or dockside sewerage treatment and garbage disposal plants have not been installed, because of a lack of public interest, the unavailability of private or public funds and the lack of enforcement of existing laws. Funds are needed for hiring and supporting enforcement personnel required to adequately do the job.

A nationwide educational program is needed to awaken each person, industry and municipality to their responsibility in the abatement of water pollution from watercraft. Legislation with funds and personnel

to implement it are also needed.

Uniform State Laws would certainly be desirable. Research is needed to perfect compact, efficient treatment devices for the recreational boats with sleeping quarters and larger boats which have permanent crews.

Legislation

The following is a summary of the existing State Laws:

Colorado

The Colorado Department of Game, Fish and Parks is responsible for the registering of every motorboat and sailboat operating on the waters of the State of Colorado. They also have the responsibility of establishing regulations for the operation of watercraft. One of the regulations is as follows: "No persons shall maintain or operate upon the waters of this State any vessel which is equipped with a water closet unless the same is self-contained, incapable of discharging directly into the water. It shall be unlawful to deposit or discharge human wastes or other refuge into the water."

Iowa

The State Conservation Commission is responsible for the establishment of boating regulations. The regulations require the registering of all motorboats every two years. At the suggestion of the State Department of Health, a question regarding available toilet facilities is included in this year's registration form. The regulations include the following section in regard to littering: "No person shall place,

caused to be placed, throw or deposit onto or in any of the waters, ice or land under the jurisdiction of the State Conservation Commission any cans, bottles, garbage, rubbish or other debris."

A meeting with Conservation and Health Department officials of Nebraska and South Dakota was held last year for the purpose of discussing uniform boating regulations. This is to avoid difficulties now existing with nonuniform requirements on the Upper Mississippi River. Legislation requiring holding tanks for storage for water from marine toilets will be considered as a more positive means of control. The Conservation Commission would prefer no legislation in the present legislative session because of the possible opposition from the Outboard Boating Club Association.

Kansas

The Kansas Forestry, Fish and Game Commission is responsible for the registering of all motorboats in Kansas. The Department of Health as courtesy to the Corps of Engineers, provides certification programs for marine toilets located on watercraft operating on Corps managed impoundments. Maceration and chlorination of the sewage prior to discharge is required for certification. A small number of boat owners have installed such required equipment. However, a larger number of owners have removed the toilet or made it inoperative by installing a blind flange.

The State Department of Health does not anticipate any appreciable increase in the use of vessel equipped with marine toilets in the foreseeable future. Should such an increase occur, they will seek appropriate

legislation to control any water pollution problems that may arise.

Missouri

The Missouri Boat Commission has the responsibility of registering all motorboats with motors in excess of 10 horsepower. The control of waste discharge from watercraft is assigned to the Water Pollution Board. The regulations of the Missouri Boat Commission do include a section on littering which reads as follows: "No person shall throw or place any glass, glass bottles, cans, garbage, trash, refuge or rubbish of any kind on the navigable waters of this State or on the banks of any navigable stream or on any land or water owned, operated or leased by the State."

Minnesota

The Minnesota Department of Conservation, Division of Game and Fish has the responsibility of registration of pleasure craft in Minnesota. An act relating to watercraft providing for the regulation of marine toilets and disposition of waste from watercraft is administered by the Water Pollution Control Commission. No untreated sewage or other wastes, nor any container of untreated sewage of other wastes, shall be placed, left, discharged or caused to be discharged in or near any waters of this State from a watercraft in such a manner or quantity as to recreate a nuisance, a health hazard or pollution of such water. A person who violates any provision is guilty of a misdemeanor. A watercraft or marine conveyance equipped with a marine toilet must be licensed and the license depends on the installation of an acceptable treatment device. The Minnesota statute

also includes a section "unlawful deposit of garbage, litter or like, whoever unlawfully deposits garbage, rubbish offal or the body of a dead animal or litter in or upon any public highway, public waters or the ice thereon public land or without the consent of the owner of private lands or water or the ice thereon may be sentenced to imprisonment for not more than 90 days or to the payment of a fine of not more than $100.00"

Montana

The State of Montana has enacted legislation to prevent water pollution by prohibiting a discharge of raw sewage from vessels. The Act states: "No vessel shall be equipped in a manner which will permit discharge of inadequately treated sewage into the waters of the State. No container of inadequately treated sewage shall be placed, left or discharged in or near water of the State by anyone at any time. All toilets located on any vessel operated on the waters of this State shall have securely affixed to the interior discharge opening of them an operating treatment device or retaining tank meeting the standards established by the State Board of Health."

The law further states that "No person shall discharge or cause, permit or suffer to be discharged in a garbage, refuge, waste or sewage of any boat into or upon the waters of any stream, river or lake within the boundaries of the State of Montana." A person who is convicted of a violation of the Act may be punished by a fine of not more than $25.00.

The State Board of Health has established the following standards for boat sewage treatment devices and sewage retaining tanks.

1. Boat sewage treatment devices which will discharge an effluent meeting the following minimum criteria are acceptable:

(a) free from unsightly floating solids

(b) has 80 percent of the 5 day 20° C biochemical oxygen demand and 95 percent of the settleable solids removed from the untreated wastes

(c) contains a most probable number (mpn) of coliform bacteria not exceeding 240 per 100 milliliters.

2. Boat sewage retaining tanks which have no provision for discharge of sewage contents into the water are acceptable.

Nebraska

The Nebraska Game, Forestation and Park Commission is responsible for the registration of motorboats in the State of Nebraska. Their regulations include the following: "Every vessel equipped with kitchen or toilet facilities shall handle and treat solid and liquid wastes in a manner that will prevent water pollution. No waste or container of such waste shall be placed, left or discharged in or near any waters of this State."

North Dakota

The North Dakota Game and Fish Department registers motorboats and develops the regulations for their use. There are very few boats in the State that have toilet facilities on board.

The State Health Department is working with the Game and Fish Department and will take necessary steps to prevent a pollution problem from developing.

South Dakota

The Game, Fish and Forestry laws pertain to requirements of vessels

equipped with kitchen or toilet facilities states: "Every vessel equipped with kitchen or toilet facilities shall be so equipped and operated to handle or treat liquid and solid wastes in a manner that will prevent pollution of the receiving waters."

Wyoming

The Game and Fish Department has the responsibility of registering boats. The Department has not as yet adopted regulations or laws on marine heads, and state they are waiting "for the full study on the Water Quality Act." When standards are set, they plan to develop a workable and enforceable law.

There is an apparent need for uniform state legislation and nation-wide uniformity among States on acceptable types of treatment facilities. Special sponsored research to determine adequate standards and test methods for sewage treatment devices for watercraft as is currently being done on a large number of units by the National Sanitation Foundation at Ann Arbor, Michigan should be helpful. Uniformity could be obtained by sponsored State or imposed Federal legislation.

Table 7

Summary of State Laws and Regulations Relating To Disposal of Wastes from Watercraft

State	Law or Regulation Yes	Law or Regulation No	Approved Method of Disposal: No Discharge	Holding Tank	Incinerator	Disinfection	Not Specified
Colorado	x		x	x			
Iowa		x					
Kansas		x					
Minnesota	x			x	x	x	
Missouri	x			x	x	x	
Montana	x		x	x			
Nebraska	x						x
North Dakota		x					
South Dakota	x					x	
Wyoming		x					

APPENDIX

Kansas State Department of Health
Environmental Health Services
April 1, 1965

Requirements for watercraft containing toilets

Permits

All owners of watercraft containing marine or chemical toilets must obtain permits from the State Department of Health certifying that the toilets meet the minimum requirements. Inspections will be made and permits will be issued through the office of the park manager.

Treatment of wastes

1. Marine toilets

   Marine toilets shall be equipped with chlorinators and macerators. Toilets not equipped with chlorinators and macerators will be cleared for operation on reservoirs provided they are made inoperative by (1) removal of a section of the discharge line or (2) insertion of a plate in the discharge line that will prevent discharge of wastes from the toilet into the reservoir.

2. Chemical toilets

   a. Chemical toilets shall be constructed of durable, corrosion resistant materials and shall be so designed as to (1) prevent spillage and (2) facilitate cleaning.

   b. The boat owner shall arrange for the disposal of the contents of the chemical toilet in "on shore" facilities in a manner that is acceptable to the State Department of Health and the health officer of the county in which the "on shore" facility is located.

STATE OF MINNESOTA
WATER POLLUTION CONTROL COMMISSION

AN ACT RELATING TO WATERCRAFT; PROVIDING FOR THE REGULATION OF MARINE TOILETS AND THE DISPOSITION OF WASTES FROM WATERCRAFT, (Minnesota Statutes 1961, Section 361.29, as amended by Chapter No. 313, Laws of Minnesota, 1963, as amended by Chapter No. 273, Laws of Minnesota, 1965)

Section 1. (MARINE TOILETS). Subdivision 1. (a) For the purposes of this section the term "watercraft" has the meaning given to it by Laws 1959, Chapter 592, Section 2, Subdivision 7, and acts amendatory thereof. (b) No person owning or operating a watercraft or other marine conveyance upon the waters of the state of Minnesota shall use, operate or permit the use or operation of any marine toilet or other similar device for the disposition of sewage or other wastes, unless the marine toilet is equipped with a treatment device of a type acceptable to the water pollution control commission of the state of Minnesota. No person shall discharge into the waters of this state, directly or indirectly from a watercraft, any untreated sewage or other wastes, nor shall any container of untreated sewage or other wastes be placed, left, discharged, or caused to be placed, left or discharged in or near any waters of this state from a watercraft in such manner or quantity as to create a nuisance or health hazard or pollution of such waters, by any person or persons at any time whether or not the owner, operator, guest or occupant of a watercraft or other marine conveyance.

Subd. 2. The water pollution control commission shall upon request furnish a list of the types of treatment devices currently available and considered acceptable for the purposes of this section for use with such marine toilets. The commissioner of conservation shall furnish the sheriff of each county in the state of Minnesota with a list of such treatment facilities acceptable to the water pollution control commission of the state of Minnesota.

Subd. 3. On and after April 1, 1966, no watercraft or other marine conveyance upon the waters of the state of Minnesota shall be equipped with any marine toilet unless also equipped with a treatment device acceptable to the water pollution control commission of the state of Minnesota; provided, however, that this requirement shall not be applicable to watercraft exempt from licensing under Section 361.03, subdivision 12.

Subd. 4. Any treatment device designed for use with a marine toilet, if in good working condition and of a type acceptable to the water pollution control commission of the state of Minnesota, is presumed to comply with the requirements of this section.

Subd. 5. The installation or presence of a marine toilet in a watercraft shall be indicated by the owner upon application for licensing of the watercraft or marine conveyance, and no license for any such watercraft bearing a marine toilet shall be issued except upon certification by the owner of the installation of an acceptable treatment device for use with such marine toilet.

Subd. 6. A person who violates any provision of this section is guilty of a misdemeanor.

Sec. 2. Not withstanding the provisions of any other law to the contrary, Minnesota Statutes 1961, Section 361.29 does not take effect until April 1, 1966, except on the waters of the Mississippi River where subdivision 3 of said section 361.29 takes effect on January 1, 1967.

Reporduced by Minnesota Department of Health, May 1965.

STATE OF MINNESOTA
WATER POLLUTION CONTROL COMMISSION

Criteria for Acceptability of Marine Sewage Treatment Devices For Use in Conjunction with Toilets on Pleasure Boats or Other Small Watercraft

June 23, 1966

1. Definitions: The following terms are hereby defined for these purposes:

   a. Marine Toilet - any toilet when on or within a boat or other watercraft subject to licensing in Minnesota, as defined in Minnesota Statutes, 1961, Section 361.29, An Act Relating to Watercraft; Providing for the Regulation of Marine Toilets and the Disposition of Wastes from Watercraft.

   b. Sewage - all human body wastes in admixture with water or otherwise as discharged from a marine toilet.

   c. Sewage Treatment Device - any device connected to a marine toilet for the purpose of treating, storing or disposing of the sewage discharged from the toilet.

   d. Effluent - the mixture of fecal material, urine, flushing water, disinfectant chemicals, or other materials as discharged from the treatment device.

   e. MPN (most probable number) - a statistical measure of the number of coliform group organisms present in water or sewage as defined in the latest edition of "Standard Methods for the Examination of Water, and Waste Water", APHA, AWWA, WPCF, and determined in accordance with such methods.

   f. Suspended Solids - the solid particles in suspension in the effluent of the sewage disposal device, determined in accordance with "Standard Methods".

   g. Chlorine Residual - as determined in accordance with "Standard Methods".

2. General Objectives:

   a. The sewage treatment device shall be constructed, installed, and operated so as to minimize to the maximum practicable extent possible nuisance conditions and health and safety hazards associated with the discharge of sewage or use of the marine toilet and treatment unit.

b. Materials used shall be reasonably resistant to corrosion under the conditions of use and of ample strength for safe operation with any commercially available marine toilet and type of watercraft.

c. The unit shall be so constructed and installed as to avoid the escape of gases or obnoxious odors into the boat, be relatively easy to operate and maintain, and function automatically with the operation of the marine toilet.

d. The disinfectant chemicals used and the treatment or disposal methods shall be such that the effluent if discharged from the treatment device to waters of the state will not be a substantial source of pollution as defined by law (Minnesota Statutes, Chapter 115), or so that the effluent and manner of discharge will not affect adversely any component of on-shore sewage disposal systems, including municipal or other sewage treatment works.

e. The acceptability of a treatment device to the Minnesota Water Pollution Control Commission generally will be based upon certification by a consulting engineer registered in Minnesota that the device (a full scale prototype, or production unit substantially equal to a stock unit chosen at random from a dealer) was tested under conditions of actual use, but not necessarily mounted in a boat, for a period of two weeks with a minimum of at least one defecation daily (and preferably more), was found to be generally satisfactory in construction and operation, and that the unit and the effluent test results meet the general and specific objectives given herein.

Reliable information from other sources, however, may be considered and upon favorable evaluation by the Executive Engineer, the subject device may be recommended to the Water Pollution Control Commission for acceptance on the basis of substantial conformance with the criteria.

3. Specific Objectives: The effluent of the marine toilet and on-board sewage treatment device combination, when discharged to surface waters, shall meet the following mimimum conditions:

   a. Not more than 5% (by weight) of the suspended solids in the effluent shall be larger than ¼ inch in any dimension, and at least 75% of the suspended solids in the effluent shall be no larger than 1/8 inch in any dimension. Solid materials readily recognizable as being associated with sewage shall be reduced to a minimum.

   b. A substantial chlorine residual shall be present in the effluent at all times (if chlorine is used as the disinfecting agent).

   c. The coliform group organisms in the effluent test samples, after dechlorination and maceration in a laboratory blender, shall not exceed 1,000 MPN/100 ml in more than 10% of the test samples, and the average of 10 consecutive daily tests shall not exceed 500 MPN/100 ml.

4. New Developments: Consideration will be given to the use of other disinfecting agents or methods of treatment if test results demonstrate that the foregoing objectives can be met.

APPROVED by resolution of the Minnesota Water Pollution Control Commission, June 23, 1966.

Robert N. Barr, M. D., Secretary
Water Pollution Control Commission

Dated: June 23, 1966

STATE OF MINNESOTA
WATER POLLUTION CONTROL COMMISSION

Sewage Treatment Devices
for Installation on Pleasure Boats
or Other Small Watercraft

The Water Pollution Control Commission on the dates indicated accepted the following devices for use in conjunction with marine toilets on pleasure boats or other small watercraft for treatment of sewage, as required by Section 361.29, Laws of 1961.

1. "C-Chlor Mark 5", manufactured by Carlson and Son, 19 James Place, Metuchen, New Jersey, (December 21, 1962).
2. "Marine Chlorinator", manufactured by Apollco Corporation, 1391 Pierce Butler, St. Paul, Minnesota, (April 18, 1963).
3. "Destroilet", manufactured by La Mere Industries, Inc., Walworth, Wisconsin, (February 27, 1964). This device is accepted for use on pleasure boats with the condition that the device and all fuel tanks and other appurtenances be installed and maintained in compliance with applicable regulations of the U. S. Coast Guard (Title 46 CFR 55.16) and any requirements of the Minnesota Fire Marshal relating to the use of liquid petroleum gas on boats. The device is not acceptable for use on vessels operated within U. S. Coast Guard jurisdiction which are used in the carriage of passengers for hire because the use of liquid petroleum gas on such vessels is prohibited by Coast Guard regulations. No statement indicating acceptance of the device by the Water Pollution Control Commission shall be used in any advertising promotion or sale of the device unless the statement includes, in the same size type, the following: "Accepted as to pollution control capabilities only and not evaluated as to safety hazards".

4. "Mono-Marine Sanitation System", manufactured by Monogram Industries, Inc. 8525 Steller Drive, Culver City, California, 90231, (March 26, 1964). This device is accepted with the following conditions so that there will be no discharges of sewage from the system directly to waters of the state:

   a. The tank and/or outlet piping must be installed on the boat so that gravity discharge to the waters will not be possible.

   b. Individual tank discharge pumps on the boat are prohibited in Minnesota waters.

   c. Discharge of the tank contents may be done only by dockside or on-shore facilities and the contents may be discharged only to disposal facilities operated under a permit from the Water Pollution Control Commission.

   d. If relatively large quantities of such treated tank contents are to be discharged to a disposal system in a short period, a surge tank may be required to equalize the flow and avoid possible detrimental "slug" effects upon the sewage treatment works.

5. "Monomatic Marine Sanitation System", Model 1, manufactured by Monogram Industries, Inc., 8525 Steller Drive, Culver City, California, 90231, (February 28, 1966). This device is accepted with the same conditions given above for the Mono-Marine unit so that there will be no discharges of sewage from the system directly to waters of the state.

6. "SANITANK" system, manufactured by PEFCO, Inc., 1380 University Ave., St. Paul 4, Minnesota (interim acceptance by Executive Engineer on June 7, 1966 and confirmed by Water Pollution Control Commission on June 23, 1966). This device is accepted with the same conditions given above for the previously accepted storage tank devices (MonoMarine and Monomatic systems, No. 4 and 5 above, items a, b, c and d), so that there will be no discharge of sewage from the system directly to waters of the state, plus the following:

   e. If the chemical additive does not prove to be effective in controlling odors at the recommended dosage, the dosage shall be increased or other chemicals acceptable to the Commission shall be provided to ensure nuisance free operation.

These devices are considered to be in substantial conformance with the general objectives of the Criteria for Acceptability of Marine Sewage Treatment Devices, Minnesota Water Pollution Control Commission, dated June 23, 1966 with exceptions noted above. Additional devices may be added to this list at a later date, based upon submission of satisfactory data by the manufacturer or other sources.

The test data required by the Criteria will in general be used as a guide for the evaluation of such devices, but consideration will not be limited thereto. The Criteria may be revised at reasonable intervals of time on the basis of experience and new developments. In the event of such revision, a new list of acceptable devices will be issued.

This list was prepared for the purpose of compliance with the requirements of the Minnesota statutes, (Section 361.29, Laws of 1961, as amended by Chapter 313, Laws of 1963, and Chapter 273, Laws of 1965) relating to disposal of sewage and wastes from watercraft, and is not to be construed as an endorsement of these devices for any other purpose.

Dated: June 23, 1966

Robert N. Barr, M. D., Secretary
Water Pollution Control Commission

SOUTH DAKOTA REGULATIONS RELATING TO THE CONSTRUCTION AND INSTALLATION OF MARINE TOILETS

1. Definitions - The following terms are defined for purposes of these regulations:

   a. "Sewage" means all human body wastes.

   b. "Marine toilet" means any toilet on or within any boat as that term is defined herein.

   c. "Most Probable Number (MPN)" - a statistical measure of the number of coliform organisms present and an indicator of the degree of human source of pollution.

   d. "Detention Time" - the time or period that the sewage is retained in the device.

   e. "Septic Action" - the biological decomposition of organic matter in the absence of air with the production of unpleasant odors.

2. Effluent Requirements - A sewage treatment device for marine toilets shall discharge an effluent meeting the following minimum standards:

   a. be free of unsightly floating solids.

   b. contain a most probable number (MPN) of coliform bacteria not exceeding 240 per hundred milliliters (ml).

3. Pretreatment of Solids - Prior to disinfection, solids shall be sufficiently divided into fine particles to permit the required degree of disinfection necessary to meet the minimum effluent standards set forth in Paragraph 2.

4. Disinfecting Agent - The disinfecting agent shall meet the following conditions:

   a. be easily obtainable.

   b. constitute minimum hazard when handled or stored and form no dangerous gases.

   c. be sufficiently effective in relation to the detention time of the device to meet the effluent requirements set forth in Paragraph 2.

5. Materials

   a. Materials used shall be such as to withstand the corrosion effects of the sewage, the disinfecting agent and the flush water.

   b. Materials used shall have chemical and/or galvanic compatibility.

6. Design and Construction - The device shall:

   a. be of ample strength for safe operation.

   b. incorporate a detention chamber of size sufficient to produce an effluent which complies with the requirements set forth in Paragraph 2.

   c. not be of the type which depends on septic action as part of its treatment

   d. prevent the escape of dangerous gases or obnoxious odors to boat interiors.

   e. provide for ease of cleaning, ease of maintenance and ease of replenishment of the disinfecting agent.

   f. function automatically with the operation of the marine toilet.

   g. not require too frequent replenishment of the disinfectant.

7. Installation

   a. Installation of the device and its piping shall allow ease of servicing and replenishment of the disinfecting agent.

   b. The device shall be adequately secured independently of any connecting piping.

   c. All piping shall be sufficiently strong and durable to withstand any pressure that might be imposed upon it by normal operation of the device.

   d. Materials of the connecting piping shall meet the requirements of Paragraph 5.